# RFID in Railway Operations

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**The purpose of the Radio Frequency Identification (RFID) technology research project is to prepare a comprehensive report covering RFID technology and current use in the rail industry.**

## Introduction

The Rail Transportation Systems in today's competitive environment face complex economical and operational challenges. RFID applications have helped the rail transportation industry by improving efficiencies in operations, maintenance, asset utilization, and capacity management. Ultimately, the RFID applications have contributed to improved revenue growth by reducing costs in these areas. The team consisted of Wireless Communication Enterprise engineers and Business Development students that studied both technological aspects of RFID technology, as well as an assessment of the market. The comprehensive report includes an overview of the RFID technology, market assessment, technical specifications, programming information, deployment and installation remarks, and RFID testing and vulnerabilities. The information in this report has been collected from global rail sources. The team also used its own research by utilizing web and vendor product literature in order to have a fully comprehensive report covering RFID technology.


Figure 1. RFID tag on a railcar

## History of RFID in Rail

The idea of Radio-Frequency Identification (RFID) in rail had been around for quite some time before the technology began to fall in place in the late 1970s. Several inventions enabled the development of RFID technology including the personal computer, complementary metal oxide semiconductor (CMOS) integrated circuits, electrically erasable programmable read-only memory (EEPROM), and efficient, inexpensive microwave diodes. In the 1960's, there had been attempts to implement a barcode system, however, it failed to satisfy needs due to reliability issues and the fact that it was easily disrupted by bad weather. Transcore was the primary manufacturer of RFID, they made the first prototype in 1984. The technology was designed specifically for demanding transportation applications including rail, intermodal and motor vehicles. Widespread use of RFID started in the 1990's. Having competition from barcode systems, infrared solutions, and optical character recognition, RFID has emerged as the superior technology. It has seen continued development through the years and its long range, robustness, ability to operate in all weather, and the fact that it does not require line of sight has separated RFID from its competition.

## Market

There are several types of RFID systems, classified by radio frequencies used. Low frequencies range from 100 kHz to tens of mHZ, and have ranges of less than a metre. Communication distances for several tens of metres use frequencies from 400 mHz to 6 GHZ. RFID systems for rail in North America use frequencies near 915 mHz. RFID technology in China is one of several industries that the central government significantly supports. The goal is to improve the industry's reliability and performance in the country's railway system. The system used in China, known as ATIS (Automatic Train Identification System), is designed to identify railroad cars arriving at or departing from railway stations. It is being widely used in all railway bureaus in China. The ATIS system is mainly used to identify cargo trains whose speed is less than 100 kph, which is a current issue preventing wider use. Once this problem is solved, it could open up a tremendous

potential for RFID technology in high-speed rail operations. The global smart railways market is estimated to grow from $12.3 billion in 2013 to $39.2 billion by 2018. This means new railway projects, new technologies, and additional opportunities to utilize RFID technology could arise.

## Risks and Vulnerabilities

One of the most common of these limitations is the fact that fast moving tags are hard for sensors or readers to detect. According to our research, the speed limitations on the RFID tags today is approximately 167 kilometers per hour. This represents a huge limitation for the technology with the enormous push for high speed rail in the United States as well as other parts of the world. In order for a company to enter the market of RFID technology for the rail industry and obtain a competitive advantage, they must find a way to increase the capability of the technology to read tags at high speed. Another limitation is the fact that it is very difficult to ensure that each railcar is tagged. Since these tags are added to many cars after their manufacturing process, it is very difficult to ensure uniformity between each car. The tags pose a security risk because essentially anyone who has an RFID tag reader can gain access to the information that is store on each tag. While this information normally includes only information like the age of the train, their ultimate destination, and the contents of the train car, it is a major setback for the technology because it does not allow rail companies to keep their information confidential.

## Recommendations

RFID technology has proven to provide railway companies with a wide range of benefits including determination of train conditions, inventory management, location control, traffic and Passeger information management etc. In order to make RFID technology an integral part of a country's railway system and to get the full benefit of the technology, the process has to begin with tagging locomotives, carriages, train stations etc. and distributing tag readers along the tracks. All equipment should be integrated into the main system. The second recommendation involves solving the speed limitation issue. The speed limitation right now is 167.7 kph when reading a fast-moving RFID tag. The reliability of the information being read is obviously of significant importance and as speed increases the technology seems to face more challenges. This would be a major issue when trying to implement RFID technology into high-speed passenger lines. There would be endless potential for RFID if it could gain widespread use in high-speed environments.